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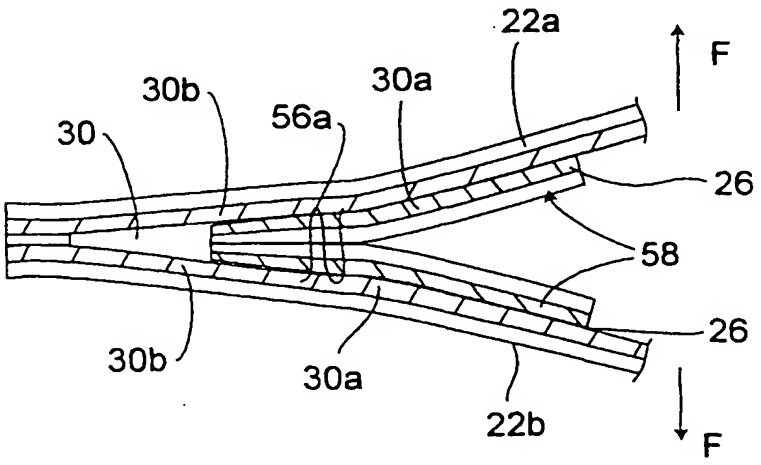
(54) Title: INFLATABLE CUSHION

(57) Abstract

An inflatable cushion (20, 20a, 100) has a first panel (22a) and a second panel (22b) attached together generally along a peripheral edge joint (30) to form an inflatable cushion. Each of the first and second panels includes a first layer (24) formed of a flexible, structural material and a bondable layer (26). A reinforcement (50) for preventing the peripheral edge joint (30) from failing has a first strip (52a) of material having a structural layer (24) and a bondable layer (26), and a second strip (52b) of material having a structural layer and a bondable layer. The first and second strips are overlaid and sewn together at a seam (56a). The seam separates each of the strips into two portions, such that the structural layers face each other and the bondable layers face outwardly abutting a corresponding bondable layer of one of the first and second panels.



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INFLATABLE CUSHION

The present invention relates to inflatable cushions such as airbags and other inflatable items.

Numerous items, such as inflatable airbags, cushions and mattresses, are made of bonded, coated or laminated material. Adjacent pieces of material are attached at a peripheral edge joint, seam or seal by welding, gluing or otherwise bonding the material together.

A primary embodiment of the invention is an inflatable airbag using laminated or coated fabrics having low or zero permeability to enable the airbag to remain inflated for a relatively long period of time. This type of airbag is useful in providing vehicle occupant protection during a vehicle rollover or multiple impact crash or an event that requires the airbag to be inflated for a long duration. To retain the airbag pressure, the various panels of material forming the airbag are coated with a polyurethane or other bondable coating. These panels are then joined together. As is known in the art, the panels can be sewn together, however, the resulting needle holes will create leak paths for the inflation gas. Alternatively, the panels can be glued or welded together such as by using sonic, radio frequency or other heat welding techniques. This type of construction bonding by eliminates the needle holes of the sewn construction, however, the resulting welded or glued peripheral edge joints can be pulled apart relatively easily. The present invention provides a method and apparatus for reinforcing these bonded peripheral edge joints. As will be apparent from the

description below, an airbag (generically a cushion) can be assembled on a flat work surface with a minimal amount of manipulation of the various parts of the airbag.

Brief Description of the Drawings

In the drawings:

FIGS. 1A, 1B and 1C illustrate an inflatable cushion with a peripheral bonded or welded peripheral edge joint;

FIGS. 2A and 2B are various views of a reinforcement member;

FIG. 3A is a plan view of a cushion utilizing the present invention;

FIG. 3B is a cross-sectional view through section lines 3B-3B of FIG. 3A;

FIGS. 3C and 3D show panels being bonded together;

FIGS. 4A and 4B illustrate an alternative embodiment of the invention;

FIG. 5 is a plan view of a side impact airbag for head protection;

FIG. 5A is a partial cross-sectional view taken at section line 5A-5A of FIG. 5;

FIG. 6 shows a manufacturing step in the construction of the cushion of FIG. 5; and,

FIGS. 7A and 7B illustrate various reinforcement peripheral edge joints used in the manufacture of the cushions of FIGS. 1 or 5.

Detailed Description of the Invention

FIGS. 1A-1C show an exemplary inflatable cushion 20. It should be noted that the thickness of the various layers 24, 26 has been exaggerated for the purpose of illustration. FIG. 1C is an enlarged view of the peripheral edge joint of the airbag of FIG. 1B. While a square shaped cushion is shown, other shapes including circular, oval or rectangular can be used with the present invention. The cushion represents an airbag formed of two joined material panels 22a, 22b. In the preferred embodiment each panel is the mirror image of the other with a coated side facing the other panel. As used herein, the panels can be formed by separate pieces of material or formed using one piece of material folded in half. Each panel comprises a multi-layered construction having a structural layer 24 and a bondable layer 26. For example, if the cushion 20 is an airbag, the structural layer may comprise 420 denier nylon or polyester woven fabric. The bondable layer 26 comprises a thin layer of an elastomer such as polyurethane, polyethylene, vinyl or nylon. One of the panels, such as 22a, has a central opening 28 therein. As is known by those skilled in the art, such an opening enables the placement of a part of an inflator within the airbag. The inflator produces or releases inflation gas to deploy the airbag.

The cushion configuration shown in FIGS. 1A and 1B is exemplary of a driver's side airbag. If, for example, the cushion 20 is used for some other purpose, the opening 28 would be removed and replaced

by a fill tube 29 that is appropriately sealed to one of the panels of material 22a, 22b and communicates with a source of a pressurized fluid such as an air compressor.

The panels 22a, 22b are joined together at a peripheral edge joint, seal or seam 30. The panels 22a, 22b may be formed using two separate pieces of fabric that are joined together along all common sides. Alternately, and as shown in FIGS. 4A and 4b the two panels may be formed from a single piece of material. In this one piece construction the peripheral edge joint does not extend completely about all of the common sides as in this cushion, one of the sides (or portion thereof) is formed by the folded-over portion of the single piece of material. The peripheral edge joint 30 may be produced by heat welding, radio frequency welding or by adhering means such as gluing the panels together. As shown in FIG. 1B, the sealable or bondable layers 26 for each of the panels 22a, 22b are laid upon each other such that when subjected to radiant energy, the bondable (for example polyurethane) coating will bond together at the molecular level. As mentioned above, the panels can also be adhesively (glued) bonded together.

When the cushion 20 is inflated, the peripheral edge joint 30, as well as any interior peripheral edge joint, is subject to a peel load which tends to pull the panels apart. This phenomenon is illustrated in FIG. 1C. As the cushion 20 is inflated the various panels are subject to an outwardly expanding force generally shown as F. The components of this force tend to rip or peel the panels apart from one another.

If the inflation pressure in the cushion is sufficiently high or, in some situations, if the rate of inflation is sufficiently abrupt, the peripheral edge joint 30 could fail. One obvious solution to increase the strength of the peripheral edge joint 30 is to reinforce the peripheral edge joint with a sewn seam. However, as can be appreciated, this type of construction can create a series of small punctures in the panels forming leak paths through which the inflation gas or fluid can escape.

FIGS. 2A, 2B, 3A and 3B show a reinforcement member 50 that is resistant to peel forces and is useful in reinforcing the peripheral edge joint 30. One important feature of the invention is that this reinforcement member 50 is located interior of the peripheral edge joint 30 such that no leak paths are formed.

More particularly, the reinforcement member 50 comprises two layers or strips of opposed material 52a, 52b formed in a designated pattern, straight, curved, open, closed, etc., conforming to the peripheral edge joint to be reinforced. The strips 52a, 52b include a structural layer 24 such as woven nylon and a bondable layer 26 such as a coating or laminated layer of, for example, polyurethane. In the preferred embodiment the material is of similar construction to the panels 22a, 22b but can be made using a different gage or thickness of structural and bondable layers. Since the peripheral edge joint 30 of FIGS. 1A or 2A that is to be reinforced extends about the perimeter of the panels of material the reinforcement member 50 is of a similar, closed shape.

The reinforcement member 50 comprises a rectangular shaped, annular band of material 54. The dimensions are chosen so that the annular band will fit within the peripheral edge joint or seal 30. This relationship is shown in FIG. 3A. The strips 52a, 52b forming the band 54 can be made of one piece or a plurality of connected or sewn pieces of material. The strips are laid upon one another such that the structural layers 24 of the strips face one another. As can be seen in FIG. 2B, the bondable layers 26 form the top and bottom of this construction with the strips in place and sewn together by thread 56. The peripheral seam 56a, formed by the thread 56, as shown in FIG. 2A, can be any acceptable seam construction such as single, double, lock stitch, etc. As can be seen from FIG. 2B, the seam 56a separates each strip, of the reinforcement member 50, into right (or inner) 58 and left (or outer) 60 segments.

The band 54 is then placed on the coated layer 26 of panel 22b and positioned to lie interior of the desired location of the peripheral edge joint (bond or seal) 30. Panel 22b is appropriately secured upon a work surface. The reinforcement member 50 can be tack welded to the panel 22b at various locations to hold it in place. For example, the location of the tack weld can be on the sewn seam or slightly offset therefrom so as not to interfere with other bonding processes. The other panel 22a is placed upon the first or under panel 22b as well as upon the reinforcement member 50 (formed as the band 54) and appropriately secured in place.

Thereafter, bonding energy, such radio frequency, sonic, friction or heat energy, is focused or otherwise applied on the fabric to seal the reinforcement member 50 to the panels. Either subsequently or simultaneously, the peripheral edge joint 30 can be formed joining the edges of the panels 22a, 22b together. FIG. 3B shows the reinforcement member 50 secured to the panels 22a, 22b. The inner segment 58 of each bondable layer 26 of the reinforcement member 50 is shown joined to the mating portion of the bondable layer 26 of a respective panel at peripheral edge joint or seal 30a, which is located on the inside of the seam 56a. While it is not necessary to bond the outside portions 60 (of the reinforcement member 50) of the bondable layers 26 of each reinforcement strip 52a, 52b to the panels this may be done as an alternate embodiment of the invention. Numeral 30b designates the location of this exterior peripheral edge joint on the outside (or left side as viewed in FIG. 3B) of the seam 56a. The peripheral edge joint 30 is also shown.

The panels 22a, 22b and the reinforcement member 50 can be secured together in a number of different ways. Various bonding techniques are well known and need not be discussed in any detail. As an example, after locating the reinforcement member 50 upon panel 22b (located on work surface 204), see FIG. 3C, an radio frequency generator 200 can be inserted within the two strips of the reinforcement member and energized by a frequency source 202. In this way, one inner peripheral edge joint 30a is first

formed and the energy need only pass through a few fabric layers. Subsequently, the reinforcement member 50 can be flattened and the other panel 22a put in place and the other peripheral edge joint 30a and peripheral edge joint 30 formed.

Alternatively, the reinforcement member 50 can be placed on panel 22b and panel 22a positioned thereon as shown in FIG. 3D. Thereafter radiant energy can be applied simultaneously to all fabric layers creating peripheral edge joints 30a (and/or 30b) and peripheral edge joint 30. The size and shape of the radio frequency generator can be made to conform to the shape of the entire peripheral edge joint to be created. As an example, the radio frequency generator can be of an annular rectangular shape to conform to the perimeter of the peripheral edge joint 30 and of sufficient width to also create one or both of the peripheral edge joints 30a, 30b. Also the radio frequency generator can be smaller than the entire peripheral edge joint to be formed; in this case the generator 200 is moved to various locations on the panels to create the peripheral edge joints in a piecemeal manner.

When the cushion 20 of FIGS. 3A and 3B is subjected to the outward, expansion forces by the inflation gas, the panels 22a, 22b will tend to move apart as illustrated in FIG. 3B in the way they tended to move apart as illustrated in FIG. 1C. However, the loading characteristics in the vicinity of the peripheral edge joint 30 and member 50 are changed. As can be appreciated, the additional lap peripheral edge joints 30a are also subject to a shearing load.

The panels 22a, 22b are prevented from peeling apart by virtue of the seamed construction of the reinforcement member 50 which is resistant to peeling loads. Even if inflation gas migrates through the seam 56a to the outside segments 60 of the reinforcement 50, such gas will be trapped within the cushion 20 by virtue of the peripheral edge joint (seam or seal) 30. Further, it should be appreciated that the sewn seam 56a is located completely interior to the panels 22a, 22b and does not create any leak paths in the panels.

FIGS. 4A and 4B illustrate a further embodiment of the invention. FIG. 4A shows a cushion 20a made from a single piece of material such as an enlarged panel 22a. Numeral 70 identifies the centerline of the panel. In this construction the cushion 20a is formed by folding the material panel in half to form both panel 22a, 22b yielding the configuration shown in FIG. 4B. As can be appreciated, the lower edge 72 of cushion 20a is closed and as such, neither a peripheral edge joint 30 nor reinforcement member 50 is needed across this closed edge. A three-sided reinforcement member 50a and the peripheral edge joint 30 extend about the perimeter of the remaining edges or portions of the cushion 20a and extend down to seal and reinforce the cushion near the edge 72. It should be appreciated that the perimeter of the cushion 20a can be circular, oval, rectangular or any other shape and can be made from one or more panels of material.

From the above, it should be appreciated that one of the benefits of the present invention is that the

construction of the cushion 20, 20a and placement of the reinforcement members 50 and the generation of the various peripheral edge joints 30, 30a and 30b can be achieved while working upon a flat work surface.

FIG. 5 shows an inflatable cushion 100 designed for use as an inflatable side impact curtain for a vehicle. The construction of the cushion utilizes many of the features of the airbag shown in FIGS. 3A-4B. Obviously, this cushion is considerably longer and designed to extend from about the location of a vehicle's A-pillar 102 across the B-pillar 104 to the C-pillar 106. Prior to activation, the cushion 100 is rolled or folded into a compact configuration resembling a long, thin cylinder and installed proximate the roof rail of the vehicle on the interior of the passenger compartment. This configuration is concealed by a trim piece (not shown) that is moved or torn away upon inflation of the cushion 100. The cushion deploys downwardly from its mounting location across the front and rear side windows of the vehicle and typically will extend to about the shoulder height of an average sized vehicle occupant, although bags that extend down lower to protect the lower arm and torso can be used. The illustrated cushion primarily provides head impact protection during a side impact crash or when the vehicle has rolled over.

The cushion 100 may comprise a plurality of panels such as a front and rear panel 22a, 22b similar to that shown in FIG. 1B or, alternatively, a single panel of material may be used following the construction shown in FIGS. 4A-4B. The periphery of the inflatable portion 100a of cushion 100 is enclosed

by a peripheral edge joint 110 having side portions 110a, 110b and a top portion 110c. These portions can be integrally formed or separately formed. If the cushion is formed utilizing separate front and rear panels, the peripheral edge joint also includes a lower portion 110d.

In the preferred embodiment of the invention, the cushion 100 utilizes a multi-layered fabric comprising the structural nylon layer and a sealable or bondable polyurethane layer. Other elastomeric materials such as polyethylene vinyl or nylon can be used. A top peripheral edge joint portion 110c may be segmented into a plurality of parts defining airflow passages 111 therebetween. The inflatable portion 100a is separated into first and second inflatable sections 112a, 112b and a center section 114. This center section, enclosed by a rectangular peripheral edge joint 126, in the illustrated embodiment is fully enclosed and is not inflated. As can be appreciated, the center portion 114 is located just behind the B-pillar. Alternatively, this center section 114 can be opened to inflation gas. The cushion 100 further includes an additional peripheral edge joint 120 that runs parallel to peripheral edge joint 110c and which, in combination with peripheral edge joint 110c, defines a tubular channel 122 as shown in FIG. 5A. Each of the inflatable portions 112a, 112b are joined together by respective separating peripheral edge joints (seams or seals) 124a, 124b.

The purpose of the peripheral edge joints 124a, 124b is to limit the inflated size of the sections 112a, 112b and is optional. A border

portion 130 of the cushion 100 extends beyond the peripheral edge joint 120. The corresponding portions of the panels 22a, 22b forming this border can be joined together or loosely abut each other. This border portion need not be sealed as completely or with as much energy as the peripheral edge joints immediately about the inflated portion 100a. A flexible tube 123 is inserted in the tubular channel 122. One end of the tube is connected to an inflator 125 which provides inflation gas. The tube 123 has a plurality of openings therethrough to introduce inflation gas into the inflatable portion 100a of the cushion. The lower portion of the cushion may include tethers 127 to prevent the cushion from moving away from the side of the vehicle.

As mentioned above, each of the bonds, seals or peripheral edge joints 110 (110a-110d, 120, 124a and 124b) can be bonded or sealed together utilizing radiant energy (radio frequency, heat, etc). Experience has shown that an adequate width for these peripheral edge joints is about 13 mm.

To prevent each of the above-mentioned bonds or peripheral edge joints from peeling apart as the cushion 100 is inflated, one or more of these bonds or peripheral edge joints can be reinforced in the manner as illustrated in FIGS. 2B and 3B. It should be appreciated that each of the peripheral edge joints of the cushion need not be reinforced by a reinforcement member 50. The gas flow pattern and pressure distribution in each cushion will differ and reinforcement members can be added as needed. Reference is briefly made to the dotted lines

designated by numerals 50a-50b which illustrate reinforcement members, positioned between the panels 22a, 22b forming the cushion 100. Each segment 110a-110d of the seal or peripheral edge joint 110 can also include a reinforcement member constructed similar to that shown in FIG. 3B. This reinforcement member has not been shown in FIG. 5 to keep this drawing as simple as possible.

A method of constructing a cushion 100 in accordance with the present invention will now be described. FIG. 6 represents a plan view of a rear panel 22a of cushion 100. The panel 22a has a plurality of mounting openings 140 therein located in the border 130. Additional mounting openings 142 are located in the lower right and left-hand extremes of the panel. The panel is laid flat upon a work surface having a plurality of pins extending outwardly therefrom. The pins are positioned at the location of the openings 140, 142. In this manner, the panel 22a can be laid flat upon the work surface and oriented by the pins. By way of illustration, if the cushion is constructed of a single piece of material, this single piece of material will form both the rear panel 22a and front panel 22b of the cushion. The front panel 22b is shown in phantom line and has openings 140, 142 therein. However, in this first step, the front panel portion 22b of this single piece of material would extend off of the work surface. In the orientation shown in FIG. 6, the facing surface of panel 22a is the bondable layer of material such as polyurethane, polyethylene, vinyl or nylon. Thereafter, straight

lengths of reinforcement members 50a are laid upon panel 22a in their desired orientation.

The construction of the linear strips of reinforcement members 50a-b is identical to the construction shown in the cross-sectional view of FIG. 2B, that is, two strips of the multi-layered fabric are laid upon each other with the bondable layers 26 facing outwardly. Thereafter, the strips 52a, 52b forming member 50a are sewn together by one or more lines of stitches of thread shown by numeral 56a. These strips may then be radio frequency tack welded such as at locations 144 to the bondable layer 26 of the panel 22a. The center, rectangularly shaped reinforcement member 50b is also placed upon the panel 22a. The construction of the center reinforcement member is identical to that shown in FIGS. 2A and 2B with the exception that its size is scaled appropriately. Additional reinforcement members such as 50c - 50e can be laid upon panel 22a proximate the location of the peripheral edge joints 110a - 110d if and where appropriate. It should be appreciated that reinforcement member 50e is not needed if the cushion is made from a single piece of material.

Each of the reinforcement members can be temporarily secured in place by one or more radio frequency tack welds at appropriate locations. The various inner and outer portions 58, 60 of each of the reinforcement members are bonded to an adjacent portion of the inner and outer panels 22a, 22b respectively. Thereafter, the outer panel 22b is overlaid upon the inner panel 22a, of course with its

bondable layer facing the bondable layer of the inner panel 22a. Thereafter, the peripheral edge joints 30a, 30b, 110a-d, 120, 124a,b and 126 are created either simultaneously or sequentially.

FIGS. 7A-7B as well as FIG. 3B show the resulting lap peripheral edge joints created between the various reinforcement members 50a, 50b and 50c. In each case, the reinforcement members provide for the increased tensile strength of the cushion in an area immediately proximate the respective peripheral edge joints 110a - 110d, 120, 124a, 124b and 126 while providing increased resistance to peeling.

Claims:

1. An inflatable cushion (100,100a) comprising:

a first panel (22a) and a second panel (22b) attached together along a peripheral edge joint (30) to form the inflatable cushion which is inflated upon receipt of inflation gas, each of the first and second panels including a first layer (24) comprised of a flexible, structural material and a second bondable layer (26), the bondable layer formed of material that is joinable to an adjacent, facing bondable layer to form the peripheral edge joint;

a reinforcement means (50) for preventing the peripheral edge joint (30) from failing including: a first strip of material (52a) having a structural layer and a bondable layer, and a second strip of material (52b) having a structural layer and a bondable layer;

the first and second strips (52a, 52b) being overlaid and sewn together at a seam (56a), the seam separating each of the strips into two portions (50,60), wherein the structural layers face each other and the bondable layers face outwardly toward a corresponding bondable layer of the first and second panel;

the bondable layers (26) of the first and second strips (52a, 52b) are joined on one or both sides of the seam to a corresponding bondable layer of one or the other panel.

2. The inflatable cushion as defined in Claim 1 wherein the first and second panels (22a, 22b) are formed by folding over a single piece of material.

3. The inflatable cushion as defined in Claim 1 wherein the cushion is an airbag for protecting an occupant of a vehicle during an accident.

4. The inflatable cushion as defined in Claim 3 wherein the cushion is divided into two or more inflatable portions (112a, 112b).

5. The inflatable cushion as defined in Claim 4 wherein each inflatable portion is joined together at an inner peripheral edge joint, each of the peripheral edge joints being subjected to a peeling load.

6. The inflatable cushion as defined in Claim 5 further comprising secondary reinforcement means for preventing peeling of the inner peripheral edge joints.

7. The inflatable cushion as defined in Claim 6 wherein the secondary reinforcement means is located adjacent the inner peripheral edge joint and comprises: a third strip of material having a structural layer and a bondable layer, and a fourth strip of material having a structural layer and a bondable layer;

the third and fourth strips being overlaid and sewn together at a seam to retard separation of the strips, the seam separating each of the strips into two portions, wherein the structural layers face each

other and the bondable layers face outwardly abutting a corresponding bondable layer of the first and second panel;

wherein the bondable layers of the third and fourth strips are joined on one or both sides of the seam to a corresponding bondable layer of one or the other panel.

8. The inflatable cushion as defined in Claim 3 wherein the cushion is a rollover airbag.

9. The inflatable cushion as defined in Claim 1 wherein the peripheral edge joint (30) is formed by one of gluing, radio frequency, sonic or heat welding portions of the panels together.

10. The inflatable cushion as defined in Claim 9 wherein the peripheral edge joint (30) is formed by radio frequency energy.

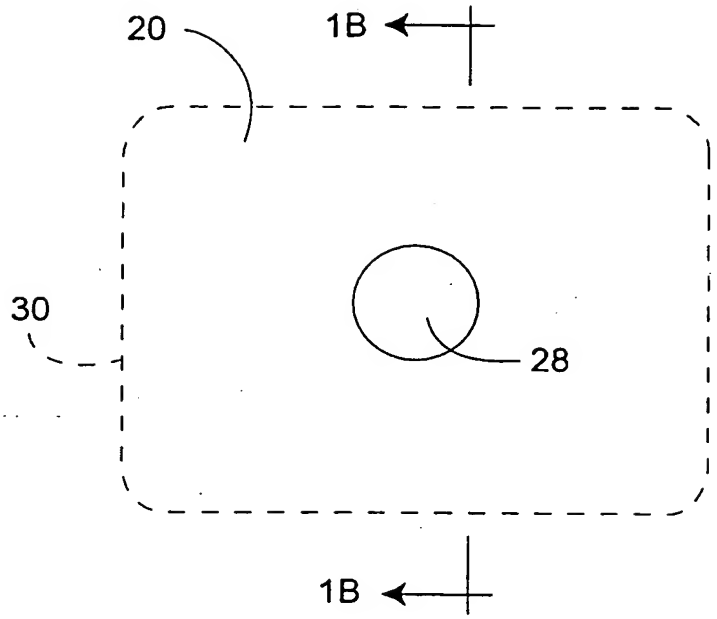


Fig. 1A

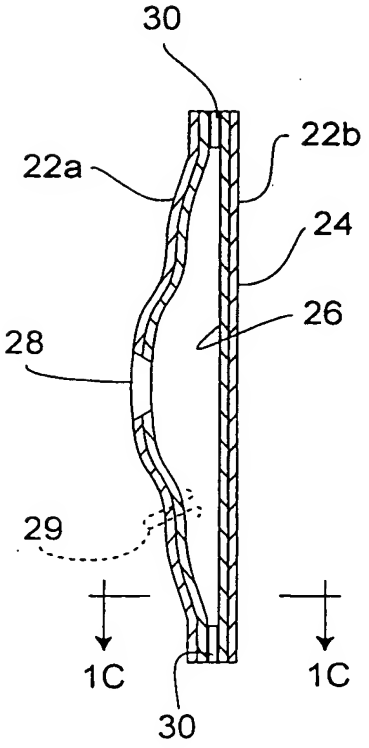


Fig. 1B

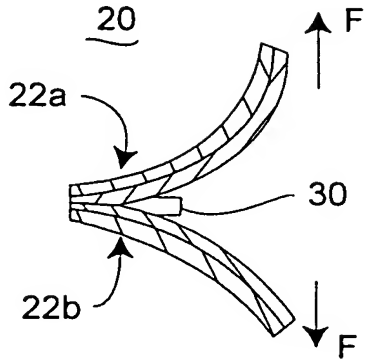


Fig. 1C

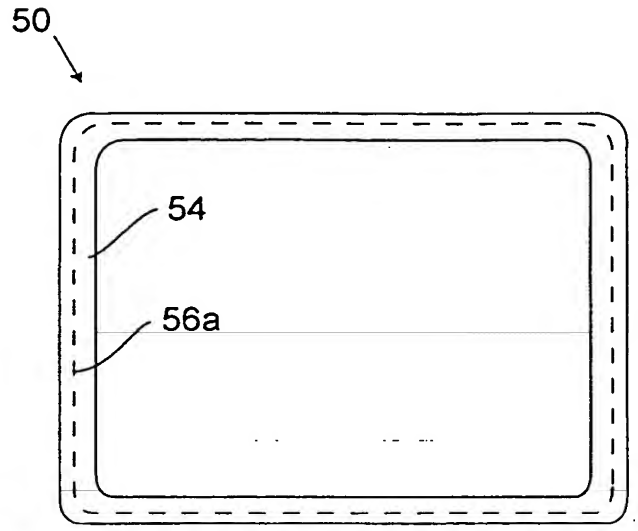


Fig. 2A

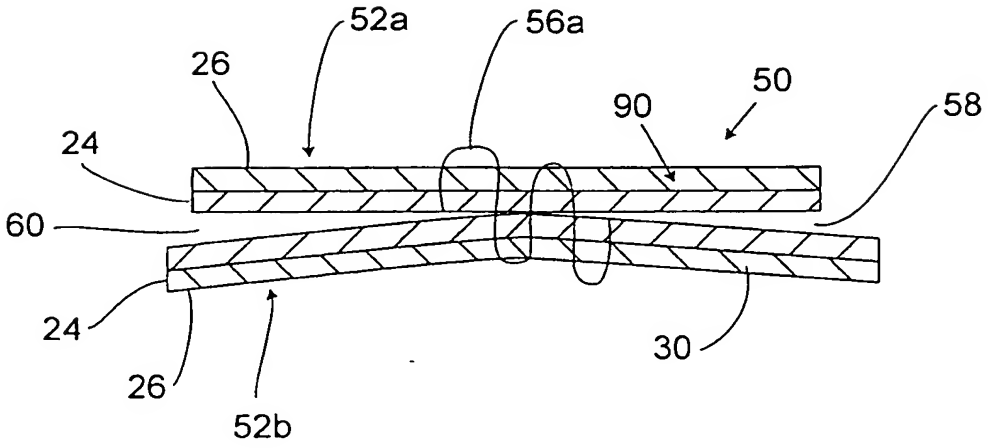


Fig. 2B

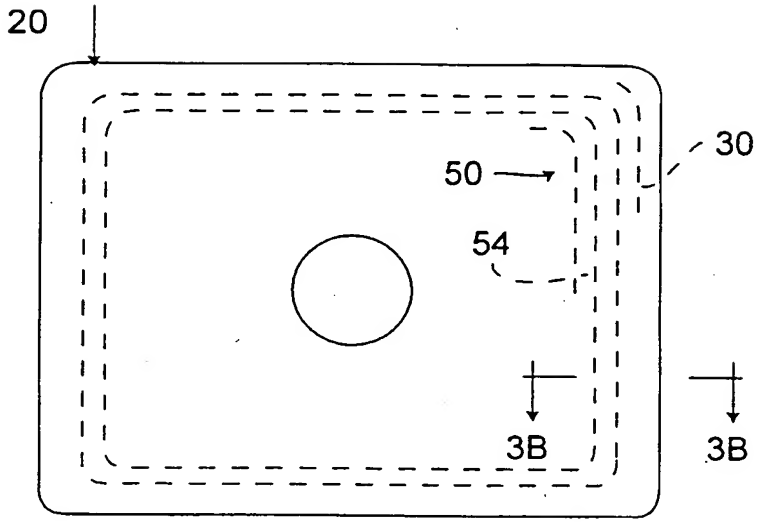


Fig. 3A

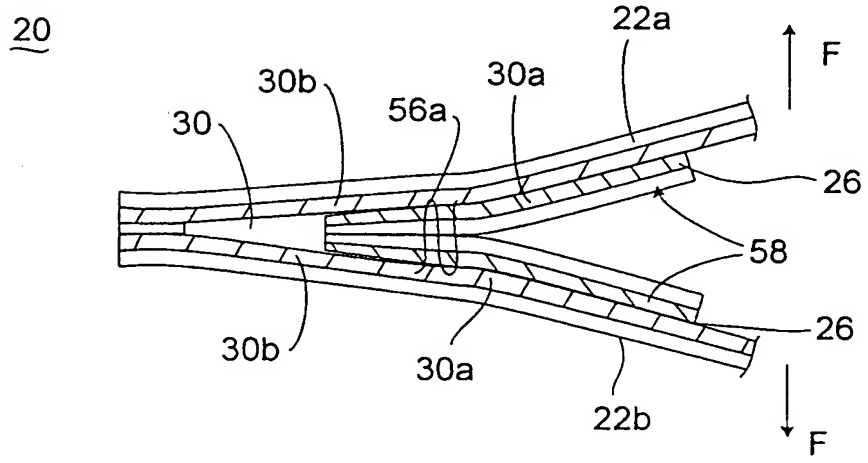


Fig. 3B

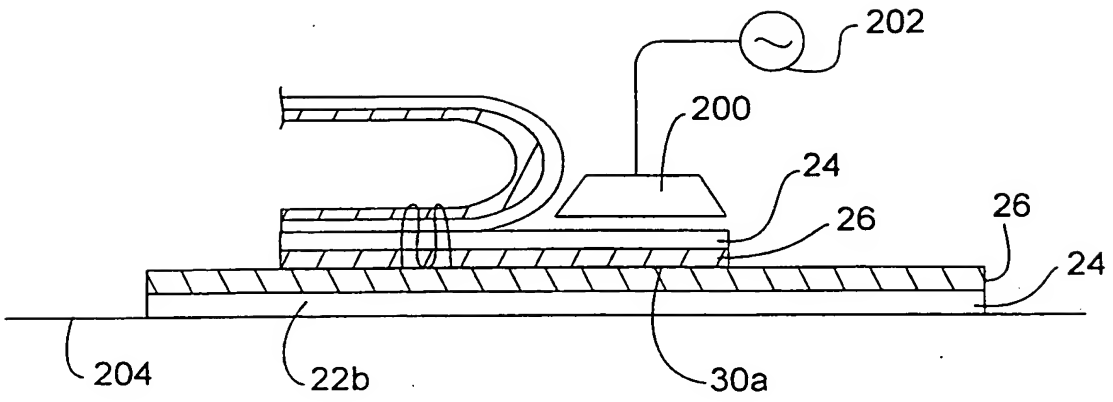
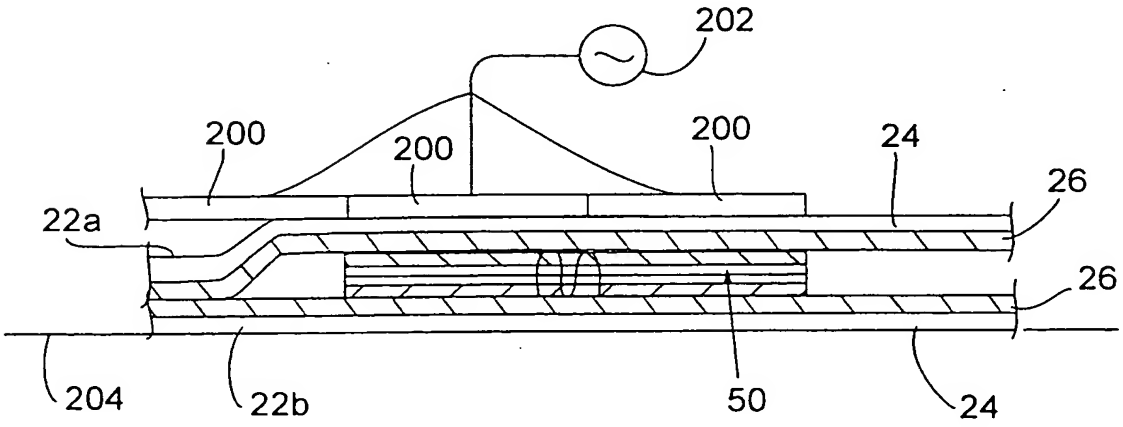

202
200
24
26
26
24
204
22b
30a

Fig 3C


202
200
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24
26
22a
26
204
22b
50
24

Fig 3D

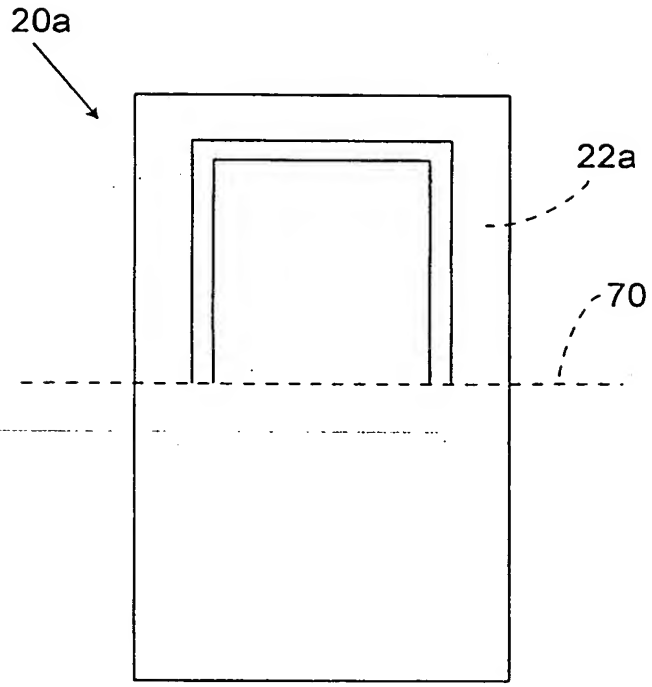

Fig. 4A

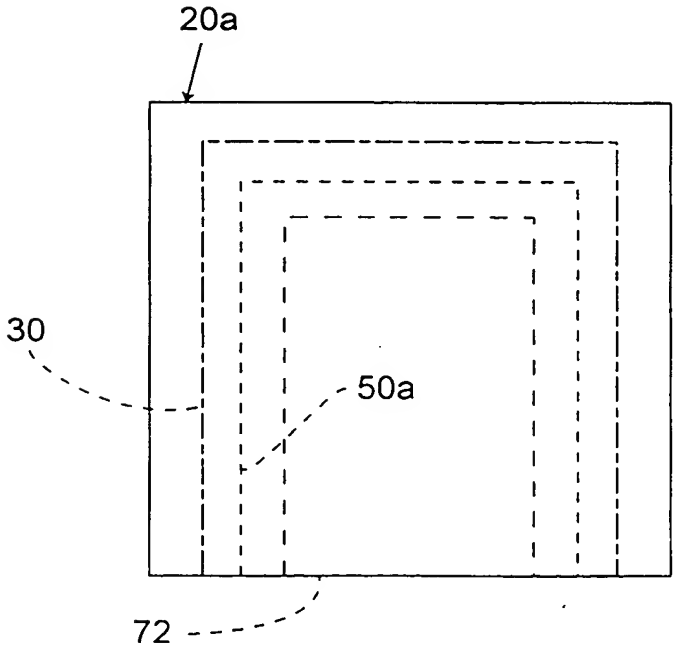

Fig. 4B

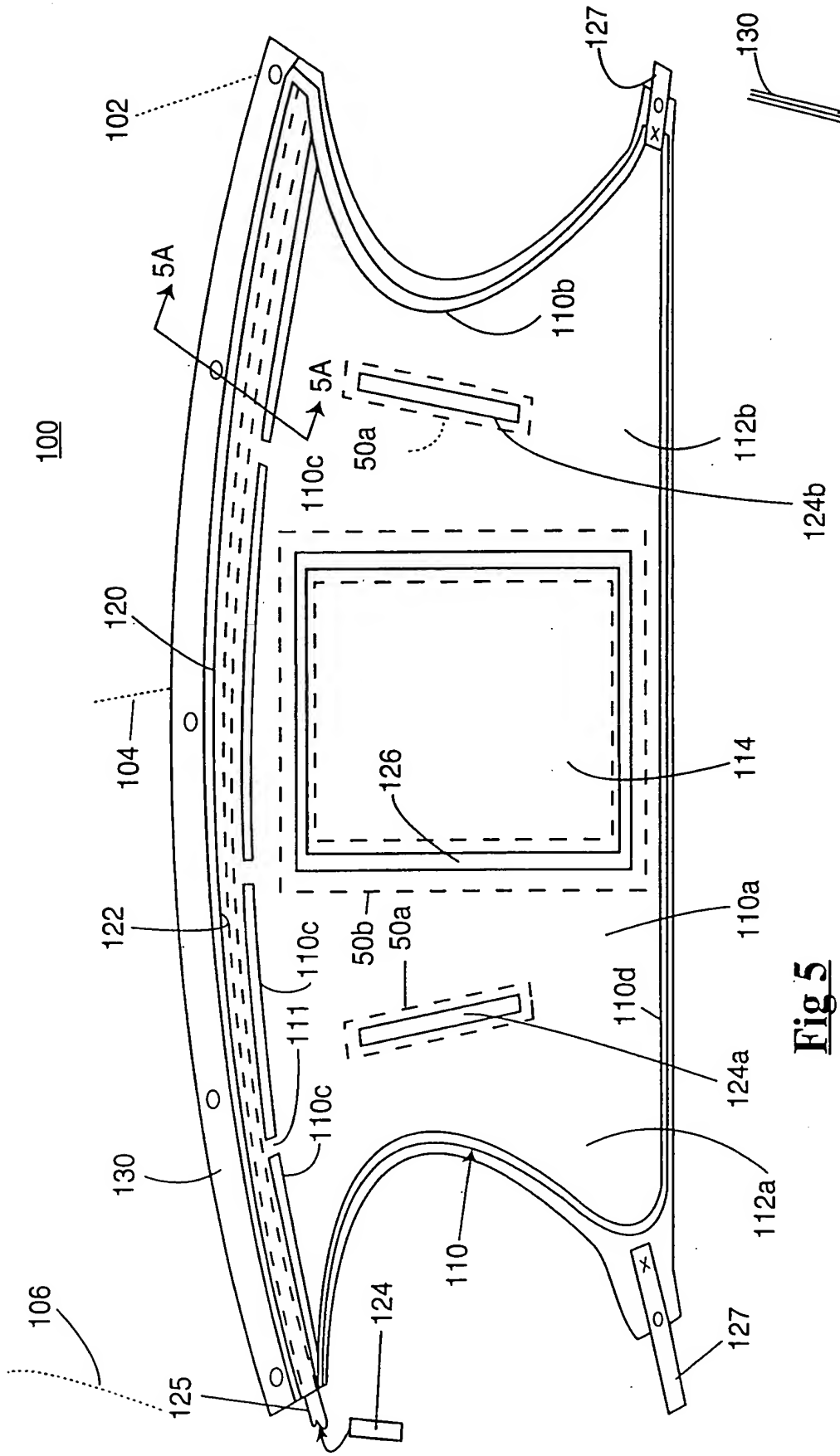

Fig 5

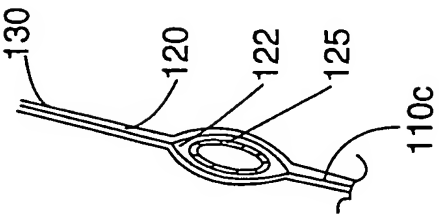

Fig 5A

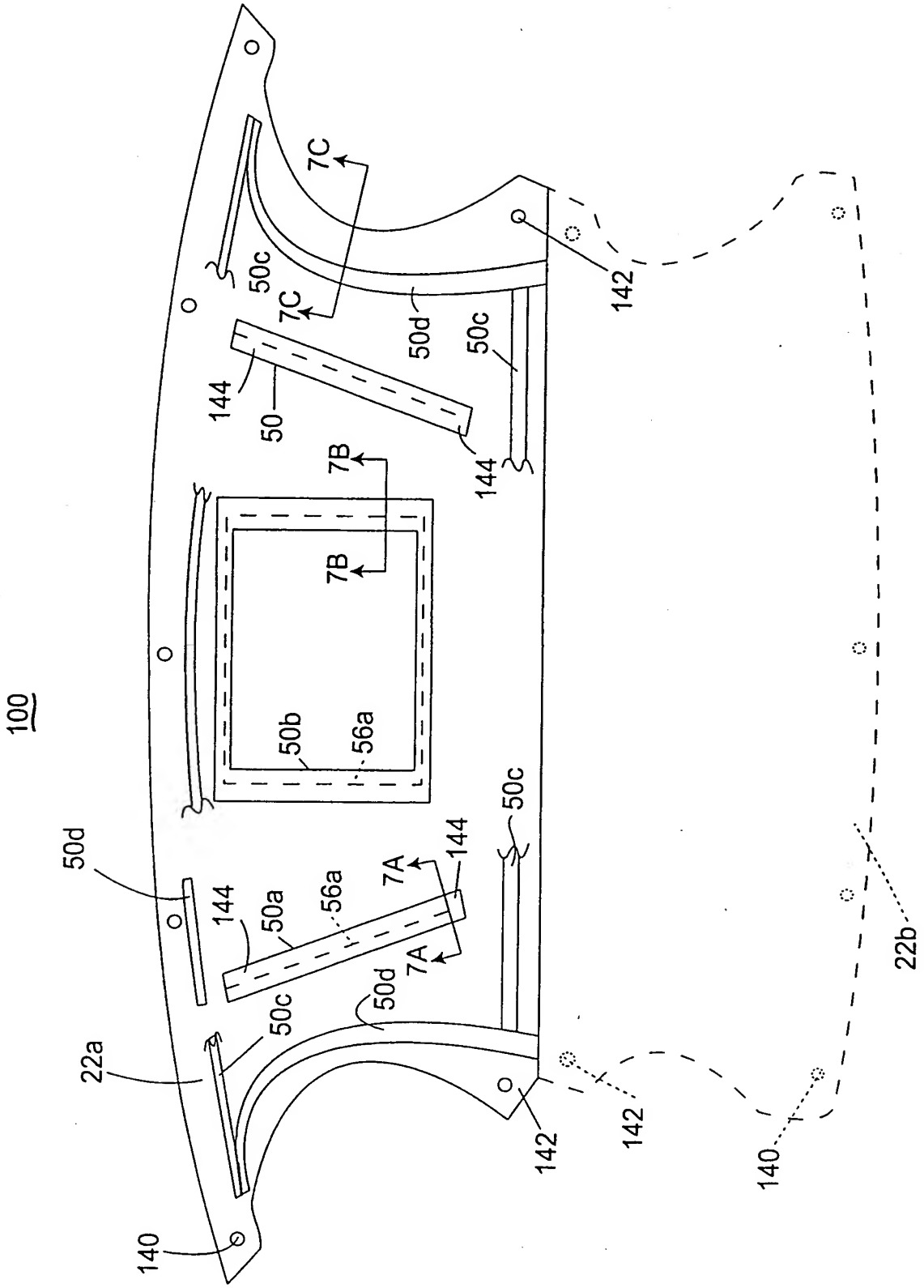

Fig 6

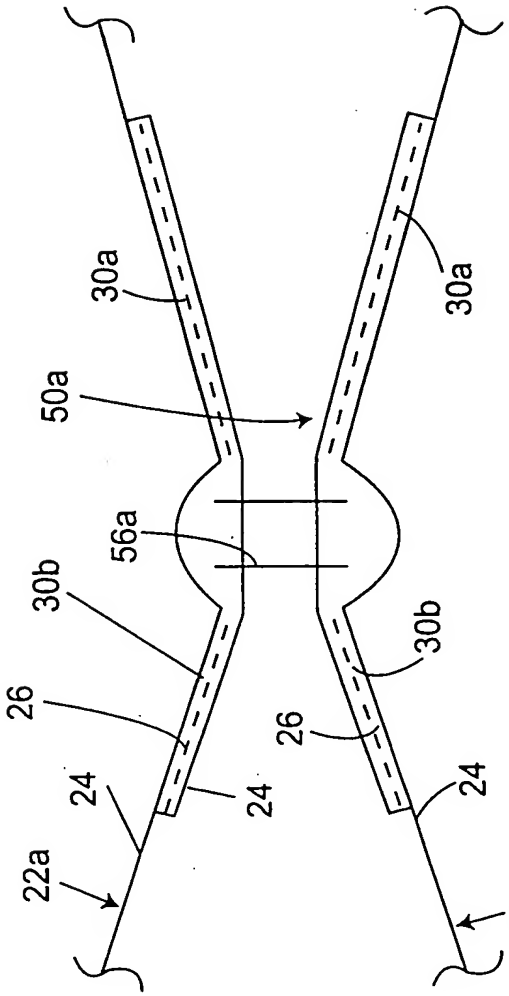

Fig 7A

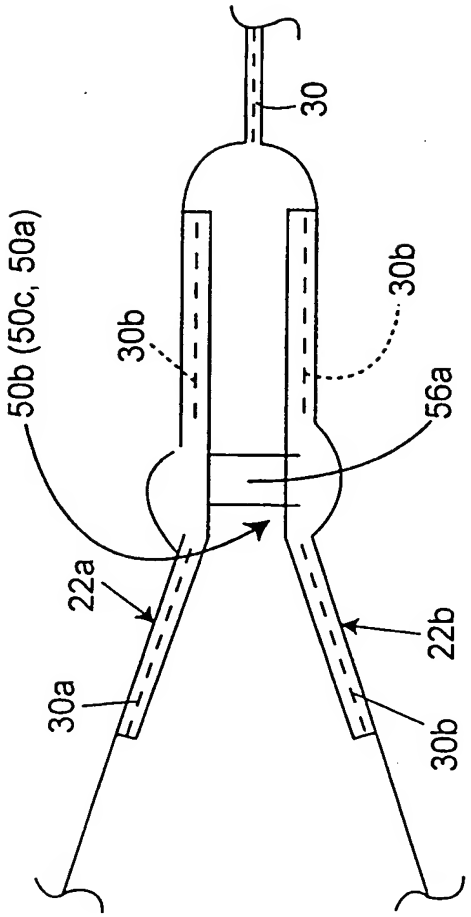

Fig 7B

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 00/06627

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B60R21/16

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B60R

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, PAJ, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	GB 2 314 051 A (BRIDGESTONE CORP) 17 December 1997 (1997-12-17) page 10, line 12 -page 13, line 2; figures 1B,3	1-3 4-10
Y	EP 0 901 940 A (TAKATA EUROP GMBH) 17 March 1999 (1999-03-17) column 8, line 9 - line 45; figures 2C,5A	4-10
A	DE 25 52 815 A (PHOENIX GUMMIWERKE AG) 26 May 1977 (1977-05-26) page 2, line 1 - line 13; figure 2	1
A	US 5 114 180 A (FUKUMORI KUNIHIKO ET AL) 19 May 1992 (1992-05-19) abstract; figure 2	1

[ ] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
3 July 2000	12/07/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Ekblom, H

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INTERNATIONAL SEARCH REPORT

Information on patent family members

Inter nal Application No
PCT/US 00/06627

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB 2314051 A	17-12-1997	JP 9119066 A	06-05-1997
		DE 19724672 A	18-12-1997
		JP 10060772 A	03-03-1998
		US 5909895 A	08-06-1999
EP 0901940 A	17-03-1999	DE 19739558 A	11-03-1999
		JP 11151765 A	08-06-1999
DE 2552815 A	26-05-1977	NONE	
US 5114180 A	19-05-1992	DE 68919345 D	15-12-1994
		DE 68919345 T	09-04-1998
		EP 0380699 A	08-08-1990
		WO 9001436 A	22-02-1990
		JP 2097805 C	02-10-1996
		JP 3128743 A	31-05-1991
		JP 7110598 B	29-11-1995
		KR 9508145 B	25-07-1995